

III. "Preliminary Account of the Morphology of the Sporophyte of *Splachnum luteum*." By J. R. VAIZEY, M.A., of Peterhouse, Cambridge. Communicated by FRANCIS DARWIN, F.R.S. Received December 3, 1888.

The investigations of Haberlandt,* published in the latter part of 1886, together with the results of investigations of my own, which were then just completed, and communicated to the Linnean Society† early in 1887, convinced me of the importance of obtaining further knowledge of the highest development to which the sporophyte of the mosses attains, as being likely to throw light indirectly on the phylogeny of the higher Cryptogams and Phanerogams. Inquiring into the matter, I found that *Splachnum luteum*, *Splachnum rubrum*, and some few other forms were the most likely to yield the best results; I determined, therefore, to obtain material for investigating their morphology. These forms being arctic or subarctic, I put myself in communication with Professor Axel Blytt, of Christiania, to find out if he could either procure me material properly preserved for the purpose, or put me in the way of obtaining material if I went myself to Norway. From my correspondence with Professor Blytt, I concluded that the only really practicable course was to go myself, and obtain my own material in the different stages in which I required it. To carry out this project, I applied for, and was granted, assistance by the Royal Society. I, therefore, now tender to the Society a brief outline of the first of my results.

I obtained after considerable search, in which I was fortunate in having the invaluable assistance of Professor Blytt and Dr. F. C. Kiaer, whose knowledge of the habitats of Norwegian mosses is notorious, a large quantity of *Sp. luteum* in many different stages of development; of *Sp. rubrum* I only obtained one specimen; but beyond the mere difference of colour there is little or no difference between the two species. The material was obtained in the marshy land on the top of the watershed between the River Glommen and Lake Miosen, and on the south-eastern side of the Dovrefjeld region.

In the sporophyte of *Splachnum luteum* we have a structure with a remarkable similarity to an umbrella, the handle end of which is inserted in the tissues of the oophyte, and is known as the foot. The seta is much elongated, bearing the umbrella-like expansion, the apophysis, at the top just below the sporangium. It is the structure

* "Beiträge zur Anatomie und Physiologie der Laubmoose;" 'Jahrb. für Wissen. Bot.,' vol. 17.

† Vaizey: "On the Anatomy and Development of the Sporogonium of the Mosses." 'Linn. Soc. Journ., Bot.,' vol. 24.

of the apophysis and certain of the organs of the sporophyte with which we are now concerned.

A transverse section through the vaginula, including the foot of the sporophyte, shows that the tissues of the oophyte in this part contain a considerable quantity of organic substance, and this is seen to be more particularly the case in the layers of cells next to the foot. The foot itself is seen to consist of a cylindrical mass of parenchyma, with an external layer of epidermal cells of a somewhat columnar form, which contain a considerable quantity of protoplasm, and contain large distinct nuclei. The protoplasm of these cells is found to be aggregated towards the peripheral surface, the nucleus being usually found in the mass of protoplasm next to the outer wall of the cell. The large vacuoles of these cells are traversed by fine protoplasmic filaments. These cells, as well as those of the cortical layer beneath the epidermis, contain a number of very small protoplasmic bodies, which are found congregated in large numbers round the nuclei of the cells, there being also some in other parts of the cell, both in the peripheral layer and in the fine protoplasmic filaments traversing the vacuole. In the epidermal cells these bodies are particularly numerous, and are found principally in the aggregated mass of protoplasm on the outer side of the cells. These bodies may, I think, be safely regarded as leucoplastids. From their number and position, I am inclined to believe that they are concerned in absorbing substances from the tissue of the oophyte for the nourishment of the sporophyte. No starch has been found in the foot.

In the centre of the foot there is a definite central strand consisting of two kinds of tissue, an outer phloëm-like layer of cells containing protoplasm by means of which it is probable that organic substance travels, and an inner strand of very thin-walled cells without any protoplasmic contents* which conducts the water up the seta. In the foot the protoplasm of the phloëm-like cells is aggregated in each cell towards the periphery as in the epidermal cells, but there are no plastids present. The strand of thin-walled empty cells† I have been able to prove in other species of *Splachnum* conveys the water absorbed by the foot up the seta into the tissues of the apophysis.

The seta has a distinct epidermis beneath which there is a layer of sclerotic supporting tissue, and then a layer of parenchyma, the two together forming the cortex. In the centre is the central strand, which in the lower end of the seta has almost the same structure as that described for the central strand of the foot, from which it is distinguished by being larger and less distinctly delimited from the

* Cf. Vaizey, *loc. cit.* The terms leptophloëm and leptoxylem have been used to indicate these tissues. For fuller explanation, see paper referred to.

† Vaizey: "Note on the Transpiration of the Sporophore of the Musci." 'Annals of Botany,' vol. 1.

cortex. Higher up in the seta there is a large intercellular canal formed in the middle of the axile strand of thin-walled empty cells which extends for nearly its whole length. This intercellular space is lysigenous in origin. A similar passage or canal occurs in several other species.

A longitudinal median section through the umbrella-shaped apophysis shows that the central strand here swells out into a large pear-shaped mass of cells, that in the mature sporophyte contain no protoplasm, and even in the younger states only a very small quantity with small, inconspicuous nuclei. Chlorophyll bodies are absent except in the two outermost layers of cells, even in the youngest specimens observed, and even here there are only a very few. The cells are all thin-walled, and cubical in shape, with no intercellular spaces between them. In this tissue, which may be regarded as a kind of aqueous tissue, large masses of crystalline inorganic matter were frequently found.

Outside the aqueous tissue there is a quantity of parenchymatous tissue, with numbers of communicating intercellular spaces. The cells all contain large numbers of chlorophyll bodies. This tissue extends into the umbrella-shaped organ. On the upper surface in the proximal region the cells are arranged close to one another, and show a distinct tendency to an elongation of their axes in a direction vertical to the surface, thus forming a palisade tissue similar to that in the tissues of the vascular plants.* This is rendered more striking by a comparison with the parenchyma of the lower surface in the same region, where the cells are much elongated in a direction parallel to the surface, and with very much larger intercellular spaces. The distal region of the apophysis shows that the cells of both upper and lower surfaces have undergone a considerable lengthening in the direction parallel to the surfaces, but that the upper as compared with the lower has still a resemblance to palisade. Stomata are found in considerable numbers in the epidermis of the upper surface, but there are none on the lower. The epidermis consists of a very distinct layer of cells without chlorophyll, the outer walls of which are cuticularised, and have a distinct cuticle.

A large quantity of starch is formed in the cells of the apophysis by the chloroplasts, each chloroplast containing a number of separate starch grains. When the apophysis is quite young, at this time being green, immediately on its beginning to become umbrella-shaped, and before the spores ripen, the starch begins to be formed. At a later stage the starch disappears, the starch-forming plastids,

* Haberlandt (*loc. cit.*) also makes a comparison between the chlorophyll-containing tissue of the sporophyte of the Mosses and the palisade tissue of true leaves; but in none of the forms which he investigated is this structure as striking as it is in *S. luteum*.

which before were large and well formed, degenerate into small and comparatively inconspicuous bodies, the starch apparently being used up in the formation of spores. In all probability there is at this period a formation of xanthophyll, which would account for the yellow colour of the apophysis in the mature condition of the sporangium, and hence the name of the species.

That the apophysis performs the functions of a leaf, and is therefore *analogous* with the leaves of vascular plants, I think there can now be no doubt. And as this structure is a development of the sporophyte, the possibility of its being also *homologous* either directly or indirectly suggests itself. I am myself inclined to believe that the two are homologous; but to give a full discussion of that question would be beyond the scope of the present communication.

IV. "A Contribution to the Knowledge of Protection against Infectious Diseases." By ALFRED LINGARD, M.B., M.S. Durh.,
Diplomate in Public Health, Cambridge. Communicated by
Dr. E. KLEIN, F.R.S. Received December 3, 1888.

It has long been known, and it is now a well-established fact, that various eruptive fevers and blood diseases from which the mother may suffer, can be communicated to the foetus *in utero*. There is evidence also to prove that a disease may be transmitted to the foetus through a mother who is herself insusceptible to contagium, as in the case of a child having been born covered with small-pox eruption, the mother being quite free from it. The following are the diseases upon which the most important observations have been made:—Syphilis, small-pox, tuberculosis, anthrax, and relapsing fever. In the three latter the organisms producing these diseases have been found in the body of the foetus at birth, having passed through the placental vessels.

In the present paper I wish to contribute to the other side of the question, viz., the relation existing between the foetus and its mother, or, in other words, *the influence, if any, exerted by the foetus on the mother, when the foetus becomes the subject of an infectious disease contracted independently of the mother*. All the comments made from this standpoint have, with the exception of one, been in relation to syphilis; the one being an instance communicated by Vidal, of a father attacked at the time of conception with small-pox, the foetus at six months being covered, during the whole of which period the mother remained healthy. With regard to syphilis, we are indebted to Colles for the first practical observation noted in 1837, when he cited as a curious fact, that he had never witnessed or even heard of an instance in which a child deriving the infection of syphilis from its *parents*, had caused an ulceration in the breast of the mother.